LOCALIZATION OF LICENSE PLATE NUMBER USING DYNAMIC IMAGE PROCESSING TECHNIQUES

Mr. Prasad Prakash Sutar[1], Prof. Pravin C. Latane[2],

[1] *P.G Student, Department of Electronics and Telecommunication Engineering, Sinhgad Institute of Technology, Lonavala, Maharashtra, India*
[2] *Assistant Professor, Department of Electronics and Telecommunication Engineering, Sinhgad Institute of Technology, Lonavala, Maharashtra, India*

Abstract - *This paper reveals about the design and development of automatic number plate recognition [ANPR]. Since it is simpler and faster than the traditional system, it has all the potential to replace the existing system. In this system we are going to work on the video. Video captured by ANPR camera and processed using dynamic image processing technique. After that edge detection and template matching is done. Finally result is obtained in ASCII character which will be converted in alphanumeric character using MAT LAB. Number plate localization stage is very important to identify the license plate number in ANPR system. This system provides very low complexity. Also provide number plate detection rate is high by using canny edge detection algorithm. The proposed architecture will be successfully implemented and tested using Model-Sim 6 and Field Programmable Gate Array (FPGA) development board. The proposed architecture will be implemented as a real time application for automated toll collection. It will be saves users valuable time by reducing the queue length in front of the toll counter.*

Key Words: Automatic License plate recognition, canny edge detection, Modelsim-6.3f and FPGA etc...

1. INTRODUCTION

Automatic license plate recognition has been widely used in intelligent transportation management systems. For some applications such as highway traffic monitoring and tracking specific cars in the highway, real time video processing is necessary, and for applications such as parking lots, automatic toll collection, automatic congestion charge systems, access control, tracing of stolen cars and identification of dangerous drivers, still image processing is satisfactory and applying it provides more accurate results.
The fundamental requirements of an ANPR system are image capture using an ANPR camera and processing of the captured image.

The image processing part, which is a computationally intensive task, includes three stages:

1] Number plate localization (NPL),
2] Character segmentation and
3] Optical character recognition (OCR).

NPL is the stage where the Number plate is detected in the input image from the ANPR camera. The character segmentation stage is an important pre-processing step before applying OCR, where each character from the detected Number Plate is segmented before character recognition so that only useful information is retained for recognition. In the last stage, optical character information will be converted into encoded text by pre-defined transformation models [1].

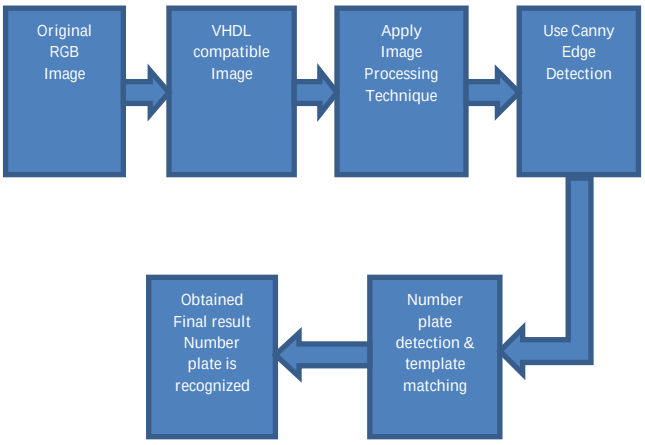

Fig 1: Basic Block Diagram

The main goal of this work is to design and implement efficient and novel architectures for automatic number plate recognition (ANPR) system using FPGA. A separate ANPR algorithm is developed and optimized, by taking advantage of technical features of FPGAs which accelerate digital image processing algorithms. The investigation of the algorithm and its optimization focused on real time image and video processing for

license plate (LP) or number plate localization (NPL), LP character segmentation (NPS) and optical character recognition (OCR) in particular, which are the three key stages of the ANPR process. ANPR often forms part of an intelligent transportation systems. Its applications include identifying vehicles by their number plates for policing, control access and toll collection.

2. RELATED WORK

Generally, license plate recognition consists of two separate parts. First, plates have to be located within the image, termed license plate detection followed by license plate character recognition, determining the plate number. The most ANPR research has been software based, the commonly used platform for this purpose often being high-performance computer workstations located at the roadside connected to an ANPR camera. Recently, researchers have started to consider the use of compact embedded hardware devices to replace these expensive computer workstations that can also be placed within ANPR camera housing. However, the issue of the necessary high levels of performance requirement set against limited memory resources associated with embedded hardware devices still needs to be addressed.
Different methods for the detection of license plates can be applied. Shapiro et al. [5] use a mixture of edge detection and vertical pixel projection for their detection module. In the work of Jia et al. [6] color images were segmented by the MeanShift algorithm into candidate regions and subsequently classified as plate or not. The AdaBoost algorithm was used by Dlagnekov and Belongie [8] for license plate detection on rather low resolution video frames. Similar features like those introduced in [4] were added to the classical set of Haar features, and the located plate was tracked over a sequence of frames. Matas and Zimmermann [7] proposed a different approach for the localization of license plates. Instead of using properties of the plate directly, the algorithm tries to find all character-like regions in the image. This is achieved by using a region-based approach. Regions are enumerated and classified due to a region descriptor using a neural network. If a linear combination of character-like regions is found, the presence of a whole license plate is assumed. The method described above can be applied to the segmentation-task of character recognition as well. Shapiro et al. [5] use adaptive iterative thresholding and analysis of connected components for segmentation. The classification task is performed with two sets of templates. Rahman et al. [9] used horizontal and vertical intensity projection for segmentation and template matching for classification.
Our focus was on the architecture and implementation of a complete LPR system on our FPGA platform. Thus, we have omitted a detailed discussion of algorithm complexity, power efficiency and accuracy. We have only cited those systems which have recently introduced new techniques to the area of ANPR.

3. CANNY EDGE DETECTION

Edge detection is a very important area in the field of Computer Vision. Edges define the boundaries between regions in an image, which helps with segmentation and object recognition. They can show where shadows fall in an image or any other distinct change in the intensity of an image. Edge detection is a fundamental of low-level image processing and good edges are necessary for higher level processing. [12] The Canny edge detector is widely considered to be the standard edge detection algorithm in the industry. It was first created by John Canny for his Master's thesis at MIT in 1983 [10], and still outperforms many of the newer algorithms that have been developed.

Fig 2. Original Image

Fig 3: Edge Detected Image

Canny saw the edge detection problem as a signal processing optimization problem, so he developed an objective function to be optimized [10]. The solution to this problem was a rather complex exponential function, but Canny found several ways to approximate and optimize the edge-searching problem.

The steps in the canny edge detector are as follows:

1. Smoothing the image with a two dimensional Gaussian. The computation of a two dimensional Gaussian is costly in most of the cases, so it is approximated by two one dimensional Gaussians, one in the x direction and the other in the y direction.

2. Find out the gradient of the image. This shows changes in intensity, which indicates the presence of edges. This actually gives two results, the gradient in the x direction and the gradient in the y direction.

3. Non-maximum suppression. Edges will occur at points the where the gradient is at a maximum. Therefore, all points not at a maximum should be suppressed. In order to do this, the magnitude and direction of the gradient is computed at each pixel. Then for each pixel check if the magnitude of the gradient is greater at one pixel's distance away in either the positive or the negative direction perpendicular to the gradient. If the pixel is not greater than both, suppress it.

4. Edge Thresholding. This method of used by the Canny Edge Detector is referred to as "hysteresis". It makes use of both a high threshold and a low threshold.

If a pixel has a value above the high threshold, it is set as an edge pixel. If a pixel has a value above the low threshold and is the neighbor of an edge pixel, it is set as an edge pixel as well. If a pixel has a value above the low threshold but is not the neighbor of an edge pixel, it is not set as an edge pixel. If a pixel has a value below the low threshold, it is never set as an edge pixel [11].

4. METHODOLOGY

Fig 4: Input Video Image

This project aims to focus on the image processing algorithm in ANPR system which is simulated in ModelSim SE 6.3f software. Video that are taken by ANPR camera with extension (*.avi) should be clear enough to be read and processed by MATLAB as an input and should not contain any defects in the number plate for example missing characters. That video file which may be converted into (*.vhd) compatible code. So here input RGB image into gray scale image conversion is done. Number plate area is identified using colour contrast method. This is because number plates in India are in black and white. After that this generated (*.vhd) compatible file with number plate and edge detection file would be opened in ModelSim SE 6.3f software.

Here canny edge detection algorithm is used for edge detection of input image. By comparing neighboring pixels horizontally and vertically, the summation of difference between neighboring pixels for each column and row is computed. These signals are then passed through a filter that removes values that are less than the average of the signal. Few candidates for the number plate area are then detected. The area with the highest contrast is then identified as the number plate area. The area is then cropped out.

After segmentation and edge detection of the number plate area, the characters are then recognized through OCR. First, the image is converted to black and white. Then, objects that are bigger or smaller than the characters in the number plates are removed. The characters are then separated individually. Each character is then compared with a set of template or generated database. The template with the highest correlation coefficient corresponding to the image defines its identity. Model-Sim SE 6.3f software output is in ASCII character format. Thus finally ASCII character output will be converted using MATLAB into the alphanumeric character and we get our final result i.e. recognized number plate.
Then the proposed architecture will be successfully implemented and tested using Model-Sim 6 and Field Programmable Gate Array (FPGA) development board.

5. SYSTEM FLOWCHART

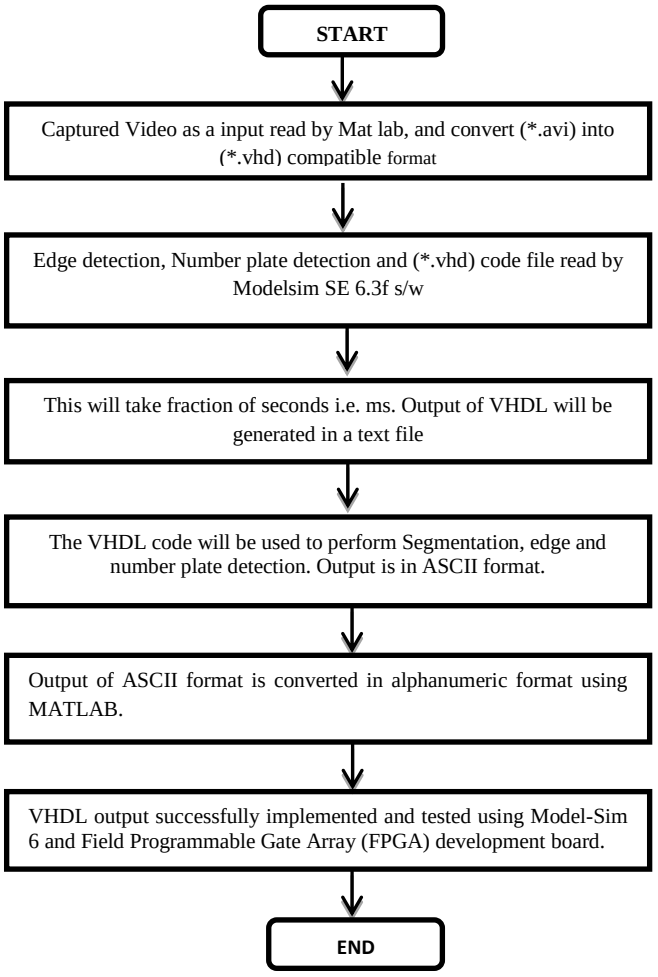

Fig 5: System Flowchart

The overview of has following steps:

- ✓ Image Capture: Capture the Video of the vehicle.
- ✓ Plate localization: Responsible for finding and isolating the plate on the picture
- ✓ Character segmentation and Edge detection: Finds the individual characters on the Plates.

- ✓ Database comparison: Comparing segmented characters with Database characters.
- ✓ Optical character recognition: Recognizes individual characters through index values.
- ✓ Authentication: It authenticates the legal license plates.

6. RESULT AND SIMULATION

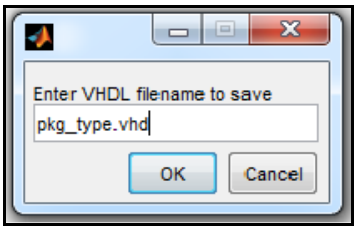

Fig 6: Enter File Name

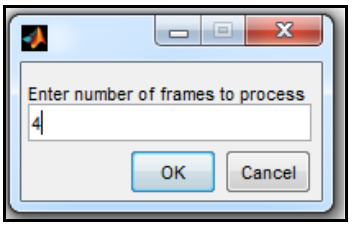

Fig 7: Enter No of Frames

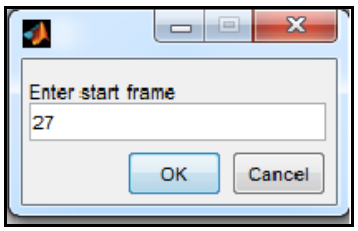

Fig 8: Enter start of Frame

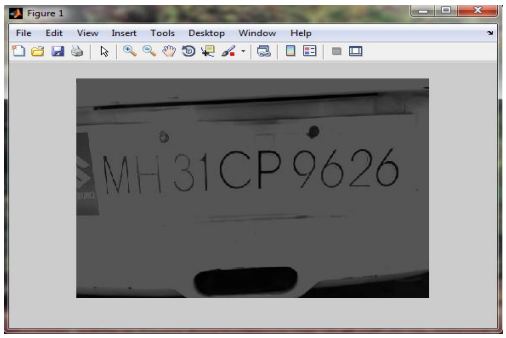

Fig 9: VHDL Compatible Image

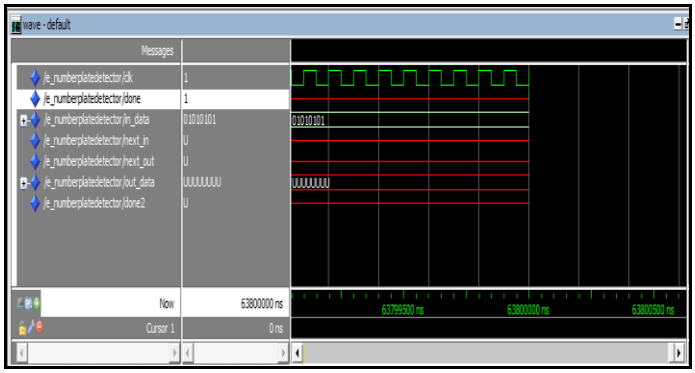

Fig 10: Simulation Result

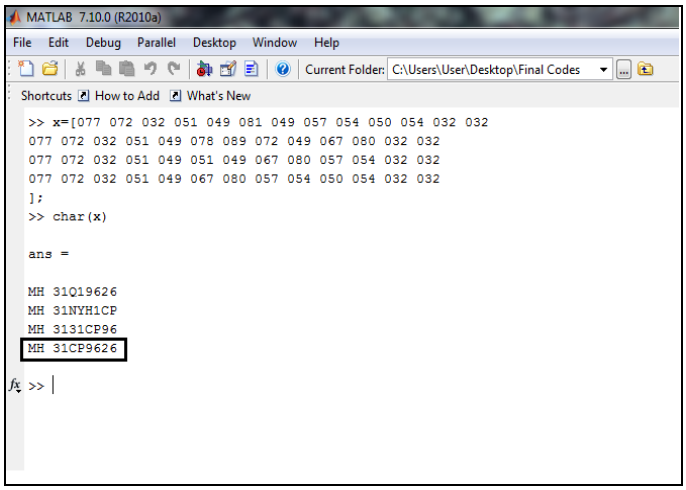

Fig 11: Detected Number Plate

5. CONCLUSION

This project reveals about the design and development of automatic number plate recognition [ANPR]. Since it is simpler and faster than the traditional system. In this system we have worked on the video. Video captured by ANPR camera and processed using dynamic image processing technique. After that edge detection and template matching is done using MODEL SIM-6. Finally result is obtained in ASCII character which will be converted in alphanumeric character using MAT LAB. Number plate localization stage is very important to identify the license plate number in ANPR system. This system gives very low complexity. Also provide number plate detection rate is high by using canny edge detection algorithm. The proposed architecture will be successfully

implemented and tested using Model-Sim 6 and Field Programmable Gate Array (FPGA) development board.

ACKNOWLEDGEMENT

I am glad to express my sincere thanks to my project guide Prof. P.C. Latane who offered me valuable tips to do my project work effective and an impressive.

REFERENCES

[1] M. Ashourian, N. Daneshmandpour, O. Sharifi Tehrani , P. Moallem "Real Time Implementation of a License Plate Location Recognition System Based on Adaptive Morphology" IJE TRANSACTIONS B: Applications Vol. 26, No. 11, (November 2013) 1347-1356

[2] Xiaojun Zhai, Faycal Bensaali, Soodamani Ramalingam "Improved number plate localization algorithm and its efficient field programmable gate arrays implementation" IET Circuits Devices Syst., 2013, Vol. 7, Iss. 2, pp. 93–103

[3] Zoe Jeffrey, Xiaojun Zhai, Faycal Bensaali, Reza Sotudeh and Aladdin Ariyaeeinia "Automatic Number Plate Recognition System on an ARM-DSP and FPGA Heterogeneous SoC Platforms"University of Hertfordshire, Hatfield, UK, AL10 9AB.

[4] X. Chen and A. L. Yuille. Detecting and reading text in natural scenes. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), volume 2, pages II–366–II–373, 2004.

[5] V. Shapiro, G. Gluhchev, and D. Dimov. Towards a multinational car license plate recognition system. Machine Vision and Applications, 17(3):173–183, August 2006.

[6] X. H. W. Jia, H. Zhang and M. Piccardi. Mean shift for accurate license plate localization. In Proceedings of the IEEE Conference on Intelligent Transportation Systems (ITSC), pages 566–571, 2005.

[7] J. Matas and K. Zimmermann. Unconstrained license plate and text localization and recognition. In Proceedings of the IEEE Conference on Intelligent Transportation Systems (ITSC), pages 572–577, Vienna, Austria, September 2005.

[8] L. Dlagnekov and S. Belongie. Recognizing cars. Technical Report CS2005-0833, UCSD University of California, San Diego, 2005.

[9] C. Rahman, W. Badawy, and A. Radmanesh. A real time vehicle's license plate recognition system. In Proceedings of the IEEE Conference on Advanced Video and Signal Based Surveillance (AVSS), pages 163–166, 2003.

[10] R. Owens, "Lecture 6", Computer Vision IT412, 10/29/1997.

[11] S. Price, "Edges: The Canny Edge Detector", July 4, 1996.

[12] M.B. Ahmad and T.S. Choi , Local Threshold and Boolean Function Based Edge Detection, IEEE Transactions on Consumer Electronics, Vol. 45, No 3. August 1999.

BIOGRAPHIES

Mr. Prasad Prakash Sutar. M.E (VLSI and Embedded System), Department of Electronics and Telecommunication Engineering, Sinhgad Institute of Technology, Lonavala, Maharashtra, India.

Prof. Pravin C. Latane. M.E (E&TC), Assistant Professor, Department of Electronics and Telecommunication, Singed Institute of Technology, Lonavala, Maharashtra, India.

